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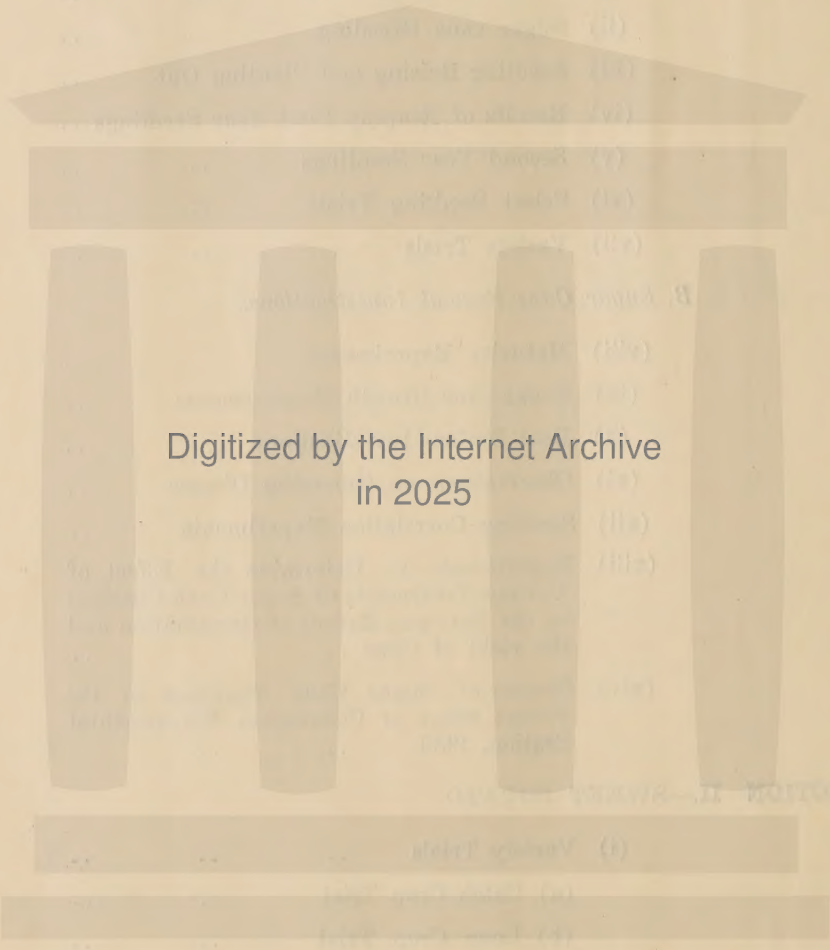

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REPORT OF THE GENETICIST FOR THE YEAR 1932-33.

By

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SECTION I.

A. SUGAR CANE BREEDING, SEEDLING SELECTION AND TRIALS.

(i) INTRODUCTION.

The scope of the work in sugar cane breeding, sugar cane seedling testing and selection increased during the season under review. This was made possible by an allocation of Imperial funds in September 1932. Sugar cane breeding in Barbados is now, as a result, directed towards supplying the sugar cane variety needs of other British West Indies sugar cane growing islands as well as Barbados. The Staff previously devoted to this work in Barbados has been increased by the addition of an Assistant Botanist, a Field Assistant and a Statistical Clerk. During the 1933 crop season the Geneticist visited the sugar cane growing islands of St. Kitts, Trinidad and Antigua with a view to formulating ideas as to the varietal type requirements of these islands. Reports on these visits will be published later.

The breeding work has been increased to embrace a wider range of parental types and the number of first year seedling plantings extended from six thousand to ten thousand. The growth measurements in the above ground parts of varieties has been extended to include first ratoons. Root system and underground branching investigations have been started and the findings will be linked up with those of the growth measurements in arriving at a clear understanding of the fundamental differences between the growth of varieties. Additional experiments have been laid down to gain an insight into the inheritance of resistance to gumming disease (*Bacterium vascularum* (Cobb) Greig-Smith), to determine the relationship between extent of leaf and stem infection in varieties and to note the reaction of seedlings and imported varieties to this disease.

(ii) SUGAR CANE BREEDING.

Sugar cane breeding was carried out at Lion Castle estate during October, November and December 1932.

The breeding work may be regarded as developing along two main lines. They are explained below.

A. This involves hybridisation between "noble" varieties (*Saccharum officinarum*). The resulting crosses are subdivided into:—

(i) those of which seedling populations have been already tested and are of sufficient value to warrant further plantings. This includes crosses

between Barbados varieties of different lines in descent. These are Ba.11569 crossed with each of the following:—B.H.10(12), S.C.12/4, B.417, B.606, Ba.6032, Ba.8069, B.603 and B.702.

(ii) crosses tried for the first time between Barbados varieties and introduced noble varieties. These are, Ba.11569 crossed with each of the following:—D.1135 (Demerara), H.Q.409 and Q.813 (Queensland), E.K.28 and S.W. 111 (Java).

B. This line of work has for its ultimate aim, by crossing, back crossing and selfing, incorporating in resulting seedlings desirable characteristics of Barbados noble varieties and varieties bred elsewhere which have evolved from breeding noble varieties with the wild sugar cane species *Saccharum spontaneum* and *Saccharum barberi*. It is a nobilisation breeding scheme, the resulting selections being guided by suitability to West Indies conditions. Subdivisions are recognised as follows:—

(a) Nobilisation of *Saccharum spontaneum*.

(i) Crosses between Javan and Barbados varieties. The Javan varieties used were P.O.J's 2364, 2714, 2722, 2725 and 2878. In all seventeen such crosses were made.

(ii) Back crosses of previously selected seedlings of such crosses to Barbados varieties. Twenty-eight of these crosses were made.

(iii) Self fertilisations of previously selected seedlings of Java-Barbados crosses. Eight of these were made.

(b) Nobilisation of *Saccharum barberi*.
Co. 213 (India) x B.H.10 (12)

(c) Crosses involving varieties derived from all three *Saccharum* species mentioned.
Ba. 11569 x Co. 281 (India)
„ x Co. 290 (India)
P.O.J. 2725 x Co. 281
Co. 281 x B.H.10 (12).

In all sixty-three distinct crosses and eight selfings were made. For the crossing work eighty arrow lanterns were employed. Selfing was effected by enclosing the arrow on each of its flowering mornings in a suitably supported pollen proof bag during the hours of pollen shedding.

(iii) SEEDLING RAISING AND PLANTING OUT.

The fuzz was collected when dry, sunned and sown in boxes in the usual manner. The relative fertilities of the various crosses were established by estimating the mean number of seedlings germinating per arrow. These figures act as a guide in future breeding work.

Adequate numbers of seedlings for potting were obtained from the majority of the crosses and selfs. Eight back crosses, however, gave poor germinations.

The important crosses Ba. 11569 x P.O.J. 2878 and Ba.11569 x Co. 281 also gave low germinations. These crosses gave poor germinations last year. The crosses Ba. 11569 x Co.290 and Co. 213 x B.H. 10 (12) failed to give any seedlings.

In all approximately eighteen thousand seedlings were potted, including populations from fifty one crosses and four selfings. The populations were kept distinct in the cisterns. Approximately ten thousand seedlings were planted out in the field in April 1932, each occupying an area of 4′ 9″ square.

The plantings were made up as follows:—

A. This includes populations from crosses between Barbados varieties. The populations are planted in contiguous blocks and some will be reaped early next crop, the others late. These crosses have been previously shown to give relatively the best seedling populations and will provide at reaping the chief media for selections for further trial and selection. Approximately seven thousand seedlings under this head were planted.

B. This section includes populations from (1) newly tried crosses and (2) crosses which are repeated chiefly to give seedlings for back crossing and/or selfing purposes. The newly tried crosses or "trial marriages" including the back crosses have populations planted in order to estimate their relative values as producers of desirable seedlings either for further trial or use as parent varieties. A population from a standard proven Barbados cross, Ba.11569 x B.H.10(12) is included here for purposes of comparing the "trial marriage" populations.

Every seedling of this category together with those of the standard has been placed at random in a separate part of the first year seedling block. So soon as results at reaping show the production of relatively superior seedlings by any new cross then its future populations will be included under category A. New crosses whose populations perform indifferently or poorly will be eliminated from future breeding.

Approximately three thousand seedlings under this head were planted. All these seedlings will be reaped in 1934 and selections for further trial and/or use as parents will comprise the B.34' series of seedlings.

(iv) RESULTS OF REAPING FIRST YEAR SEEDLINGS—CODRINGTON, 1933.

These seedlings were bred in 1931 and planted at Codrington in April, 1932. There were two time of reaping groups, i.e. (1) approximately three thousand seedlings reaped at the beginning of February and (2) approximately two thousand six hundred seedlings reaped at the beginning of May. Each seedling had been planted at random in its time of reaping block.

The populations comprising the entire seedling block are considered under the following heads:—(1) from crosess between Barbados varieties—six; (2) from crosses between Javan varieties of the *Saccharum spontaneum* nobilisation (i.e. P.O.J's 2364, 2725 and 2878) with Barbados varieties—thirteen; (3) from back crosses of selected seedlings of those to Barbados varieties—nine;

(4) from crosses between varieties of *Saccharum barberi* descent (i.e. P.O.J 2379) with Barbados varieties—four; and (5) from a cross between P.O.J.2364 x Co. 281.

At reaping, for each seedling, the following data was taken, (1) weight of canes (2) number of sound canes (3) number of rotten canes (4) average length and width of canes. Whenever possible a minimum of fifty seedlings of each population was sent to the laboratory for sucrose per cent. in juice determinations. The data was used in guiding selections of seedlings for future trial and/or use as parent material, for comparing population performances and for obtaining an insight into the endowment capacities of the parent varieties employed. For the two latter purposes the usual sets of tables—examples of which have appeared in previous reports—were prepared; i.e. tables to show for each population, (1) the percentage field and final selections, (2) the means and ranges round the means for the features noted at reaping and milling and (3) for the features weight of stool and per cent. sucrose in the juice, the percentages occurring above an arbitrarily high figure. These tables are made to serve as guides in future breeding work.

The final selections with the purposes of their selection are presented in Table I.

TABLE I.

FINAL SELECTIONS MADE FROM FIRST YEAR SEEDLINGS—CODRINGTON, 1933.

Group.	Nature of Seedlings.	Number for Further Trial.	Number for Breeding Purposes.
Early ..	Barbados Crosses	24	..
	Back Crosses	8	..
	P.O.J. 2725–Barbados Crosses ..	2	..
	Toledo–Barbados Crosses ..	3	..
	P.O.J. 2364–Barbados Crosses ..	..	9
Late ..	Barbados Crosses	16	..
	Back Crosses	11	..
	Toledo–Barbados Crosses ..	1	..
	P.O.J. 2379–Barbados Crosses ..	3	..
	P.O.J. 2364 x Co. 281	1	..
	P.O.J. 2364–Barbados Crosses ..	..	16
	Total	69	25

Those selected for further trial are passed into the usual scheme of seedling multiplication and trial while those for breeding purposes are multiplied for planting at the breeding station. It is probable that some of those mentioned for further trial will, after further observation, be used as parent plants.

These seedlings, selected in 1933 comprise the B.33′ series.

For the past four years seedlings from the following crossing groups have been obtained and tested, i.e., (1) Barbados crosses, (2) P.O.J.2364—Barbados crosses and (3) P.O.J.2725—Barbados crosses. It is now possible to make conclusions as to their values.

(1) The Barbados Crosses.

All such crosses have as their female parent, Ba. 11569. Many male parents have been crossed with this variety. It has been shown that those male parents which have been bred along lines distinct from Ba.11569 provide, on crossing with this variety, better seedling populations. Varieties in the same breeding line as Ba. 11569 are now no longer used with it as male parents.

The seedlings derived from Barbados crosses are usually of a type well suited to Barbados conditions, and, also, it would appear, to the growth conditions of the greater parts of other West Indian Islands. From the milling and juice quality points of view they are, on an average, excellent. From the field aspect they provide a medium for a selection of types suited to growth over varying lengths of favourable growing periods. Their relatively low arrowing intensities is a feature which is highly advantageous under conditions where considerable vegetative growth may still be made during and after the arrowing season. Under a considerably wide range of soil conditions they yield a relatively good tonnage of cane, and are, as a rule, easily cut and easily transported.

They have, on the average, several defects. Ease of germination and rate of crop establishment are rather variable in these seedlings, and, on the average, not so good as the Javan P.O.J. series or the Indian—Coimbatore—series. Although the length and width of the canes are very good, they tend to lack number in the stool. Perhaps their greatest defect lies in their susceptibility to drying out and/or rotting during crop. Their canes on ageing offer little resistance to unfavourable conditions and, on the least injury, are very susceptible to attack of weakly parasitic and saprophytic fungi. In these respects they are greatly inferior to the Coimbatore varieties. They are not likely to provide types which may be expected to succeed in poor soils, although they have produced types which may yield relatively well under an annual rainfall of slightly below forty inches.

There is no doubt that crosses between (1) Barbados varieties and (2) between Barbados varieties and noble varieties from elsewhere will give seedlings which will be improvements on the existing commercial varieties in one or more respects for different conditions in the West Indies. While these may possibly be obtained in the near future, it appears that as a general rule time will be required to remove the defects of these seedlings and to increase the range of their adaptabilities by incorporating into them, by breeding, the desirable characteristics of commercial sugar cane varieties derived from *Saccharum officinarum* when crossed with other *Saccharum* species. The ultimate limit to improvement through Barbados crosses alone is realised and has prompted breeding along the lines suggested.

(2) P.O.J. 2364—Barbados Crosses.

P.O.J. 2364 in Barbados is used as a female parent. It has been crossed with nine Barbados varieties and the resulting populations given adequate testing under Barbados conditions. As with all sugar cane crosses already tried in Barbados, considerable variation is obtained in the progeny, so with these crosses. Yet, they tend throughout to possess characteristic features.

They germinate well from cuttings, have at first a flat spreading habit, then become erect. The cane widths of selected seedlings compare well with those of Barbados varieties and they possess on an average about 20% more canes per stool. The canes grow fast but arrowing is very marked in canes produced any time up to August. The arrowed canes cease growth and late shoots are produced (as in P.O.J. 2878). The arrowed canes tend to become pithy, produce side shoots and in many cases dry back during crop time. In their first year, when the growing season is approximately five months shorter, arrowing is absent or nearly so, and these crosses relative to Barbados crosses yield extremely well. When they are planted from cuttings at the normal planting time, however, arrowing is heavy and they yield lower than the selected Barbados crosses.

The percentages of sucrose in the juice averages about 15% lower than those of the Barbados crosses.

So far their seedlings have shown markedly high resistance to gumming disease as judged by susceptibility to leaf symptom development. Their reaction to mosaic disease has not been determined, but it is probable, as has been experienced in other countries, that their resistance is high.

In summary, these crosses have two marked defects, i.e. (1) heavy arrowing and (2) low per cent. sucrose in juice. Back crossing the best of these crosses to Barbados varieties is now being done with a view to eliminating these undesirable features. At present a search is being made by a study of populations, for the most promising parents in these crosses.

(3) P.O.J. 2725—Barbados Crosses.

P.O.J. 2725 is used as a female parent. So far it has been crossed with nine Barbados varieties.

The resulting seedlings show many resemblances to the P.O.J.2364—Barbados crosses. They show the same ultimate upright habit and heavy arrowing. Their cane number, however, only equals, on the average, that of the Barbados crosses.

The per cent. sucrose in juice is on the average as high as the Barbados crosses.

They show the same marked resistance to gumming disease as the P.O.J. 2364-Barbados crosses.

Selected seedlings of those first crosses are being back crossed to Barbados varieties, since none of their seedlings tested show immediate promise in Barbados.

(v) SECOND YEAR SEEDLINGS.

These seedlings were selected from the 1931 first year seedling block. They, therefore, constitute the B.31′ series of Barbados seedlings. Two groups were selected, i.e. (1) from an early reaped block and (2) from a late reaped block. They were multiplied during 1931 and prior to planting in November of that year a minor selection was made in each group. Each time of reaping group was then planted at two estates, Dodds and Lemon Arbor, a lower and a higher rainfall estate respectively. The early group contained twenty-eight seedlings and the late group twenty-five and each group at each place was tried against its accepted commercial standard varieties. The usual lay-out was employed.

At reaping the early and late groups were reaped early and late in crop respectively. The same field and laboratory data was taken as in previous years and statistical inquiries made.

The following selections for further trial were made together with a scheme for allocating the seedlings to trial in districts where conditions appear most suited to each and for a time of reaping in crop which is suggested by the growth type of each seedling.

DISTRICT.

roup	Variety.	Lower Rainfall Sandy Coral Limestone.		Lower Rainfall Black Coral Limestone.		Lower—Inter. Rainfall Black Coral Limestone.		Lower—Inter. Rainfall Deep Black Coral Limestone.		Inter—Higher Rainfall Red Coral Limestone.		Higher Rainfall Red Coral Limestone	
		Early.	Late.	Early.	Late.	Early.	Late.	Early.	Late.	Early.	Late.	Early.	Late.
arly	B. 3124	+*		+	+	+	+	+					
	B. 3125			+		+	+	+	+	+	+	+	+
	B. 3127		+	+	+		+	+	+	+		+	+
	B. 3138	+		+		+	+	+		+			
ate	B. 3179					+	+	+	+	+	+	+	+

* These selections will be given a further trial under conditions denoted by a plus sign.

Several difficulties with those second year trials have been experienced and the system is being gradually altered to meet them.

Owing to the rather poor germinations from cuttings of single first year stools and to the shortness of the time for multiplication until the planting of the second year trials—approximately nine and six months for early and late group selections respectively—it is in many cases difficult to obtain an adequate number of cuttings for planting and supplying. Again, many of the minor selections made just prior to planting have been proved to be of insufficient worth to warrant trying in second year trials.

To meet these difficulties first year selections are now multiplied on a smaller and more uniform plot. At the previous second year planting time each is planted in a sufficient number of holes to avoid any chance of shortage if it should be finally selected for second year trial. The original plantings are retained until the crop season and tentative selections made then. These selections are then examined for arrowing from the second plantings and final selections made prior to planting out in second year trials.

This scheme delays the second year trial for one year but the advantages derived are sufficient to warrant this.

This has so far been done with the late group of the B.32′ series and will be done with both groups of the B.33′ series.

(vi) SELECT SEEDLING TRIALS.

These are more comprehensive trials given to those seedlings selected in the second year. During the 1933 crop the trials of the B.29′ series of seedlings against the selected commercial varieties were reaped.

A. Plant Cane Trials.

Each trial contained two sub-trials; one for early and the other for late reaping. The number of varieties and lay-outs employed at each station varied. Two cuttings were planted to the cane hole. Where both germinated, one was taken out. Supplying was done after a suitable time had been allowed for germination of the original cuttings. The object of double planting with subsequent singling and early supplying was to ensure, as far as practicable, an early and full stand; a highly important feature in trial work.

The plot size throughout was 48 cane holes. This number represents an area, according to the hole spacing employed of 1/26 to 1/36 acre.

At reaping all 48 holes were reaped, the millable canes weighed, the number of rotten canes ascertained, and a sample of 120 lb. of cane sent to the Laboratory. With regard to the latter, for each sub-trial one block was selected from which the Laboratory sample of each variety was completely analysed. The samples from the remaining blocks had sucrose per cent. in juice determinations made. For estimating the per cent. sucrose in cane the mean sucrose per cent. in juice of all the samples of any variety was fitted into its complete analysis.

The lay-outs employed in the trials were:—Coverley and Buttals both reapings, four randomised blocks, Blackmans, both reapings, Clifton Hall, late reaping, six randomised blocks and Clifton Hall, early reaping, a five by five latin square.

Statistical analyses of variance were made for the features weight of cane and per cent. sucrose in juice and significant differences between variety means determined.

The results are presented in diagrammatic form on Plates I and II.

The differential responses in production of sucrose per acre to different places and/or dates of reaping are well seen in these plates in the performances of B.726 and B.H. 10 (12) and especially B.2935 and P.O.J. 2878. These findings emphasize—as has been done in previous reports—the necessity of considering these two factors in establishing the commercial value of any variety.

SUMMARY OF RESULTS OF SELECT SEEDLING TRIALS.

The imported variety P.O.J.2878 and the following seedlings were tried against the standard varieties in the particular trial districts:—B.2739, B.2901, B.2919, B.2931, B.2935, B.2937, B.2945, B.2947, B.2976, B.2977.

Notes are given on those selected for further trial.

B.2935. This is a seedling derived from the cross Ba.11569 x Ba.6032.

In all its trials it has shown great promise for lower rainfall districts and on that account its field and factory characteristics are described rather fully here.

It germinates well and tillers at first slowly but later more freely. The early tillers produce cane internodes early (cf. B.417), and the cane stool is formed early in the rainy season. The canes grow on the average relatively faster than the other commercial varieties grown in Barbados. Cane growth is prolonged and the resulting canes at crop are very long and thick and weigh heavily. Arrowing is sparse in the drier districts and below average in the rainier. Where growth is advanced a considerable production of late ("October") shoots results. These may form appreciably sized canes (cf. B.417). The average number of canes to the hole approximates to that for Ba.11569. The long and heavy canes tend to lie down relatively early, but at crop back-rooting is little in evidence.

The extent of rot among canes at crop time depends on the length of the favourable growing season. Where this is longer, e.g., in the rainier districts rotting is very marked in the earlier formed canes. Where, however, as in the lower rainfall districts the favourable growing period is shorter rotting is not much in evidence.

In the higher rainfall districts where juice ripening is slower the juice of this variety improves very slowly. This is more so on account of the presence of late formed canes. In the conditions of the lower rainfall district which favour fast juice improvement, the juice appears to equal that of Ba.11569.

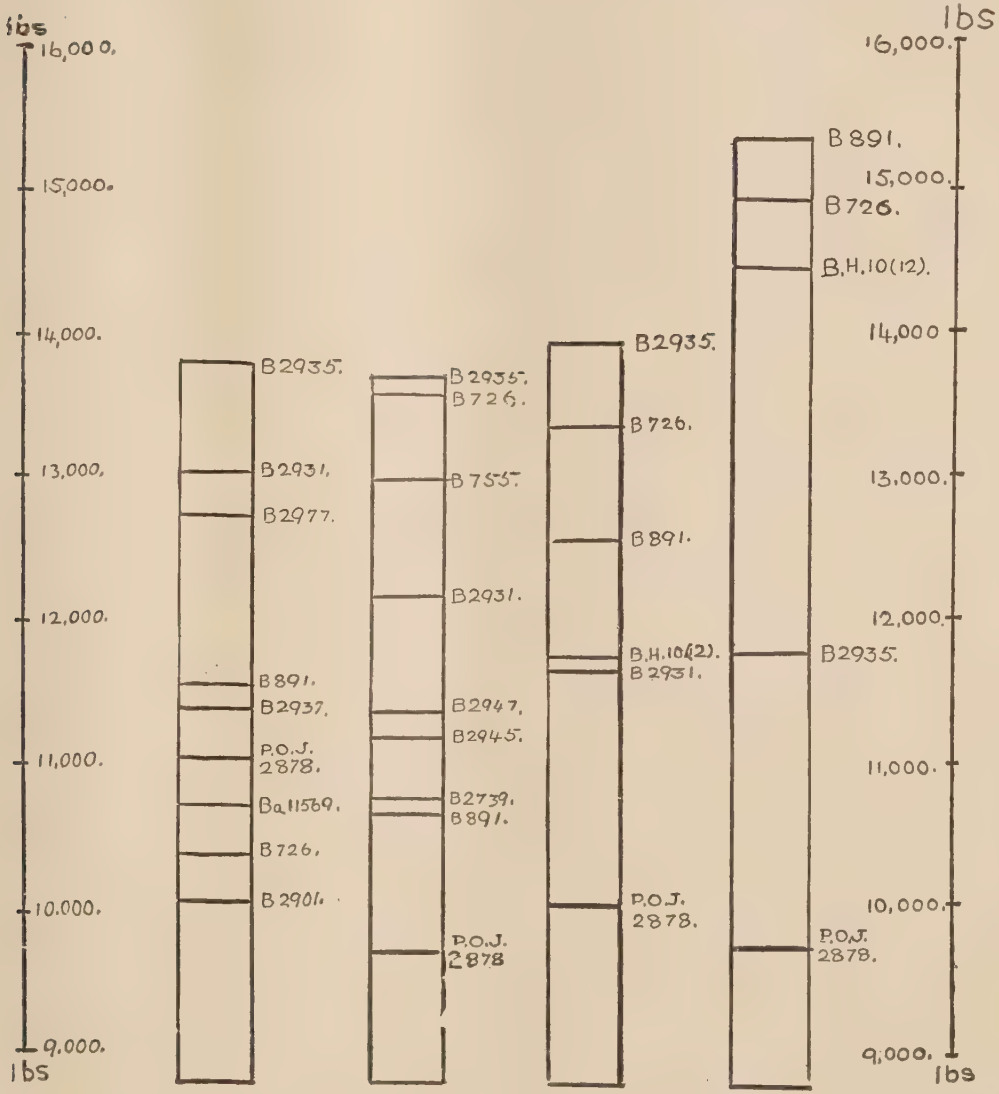
PLATE I.

SELECT SEEDLING TRIALS.

PLANT CANES.

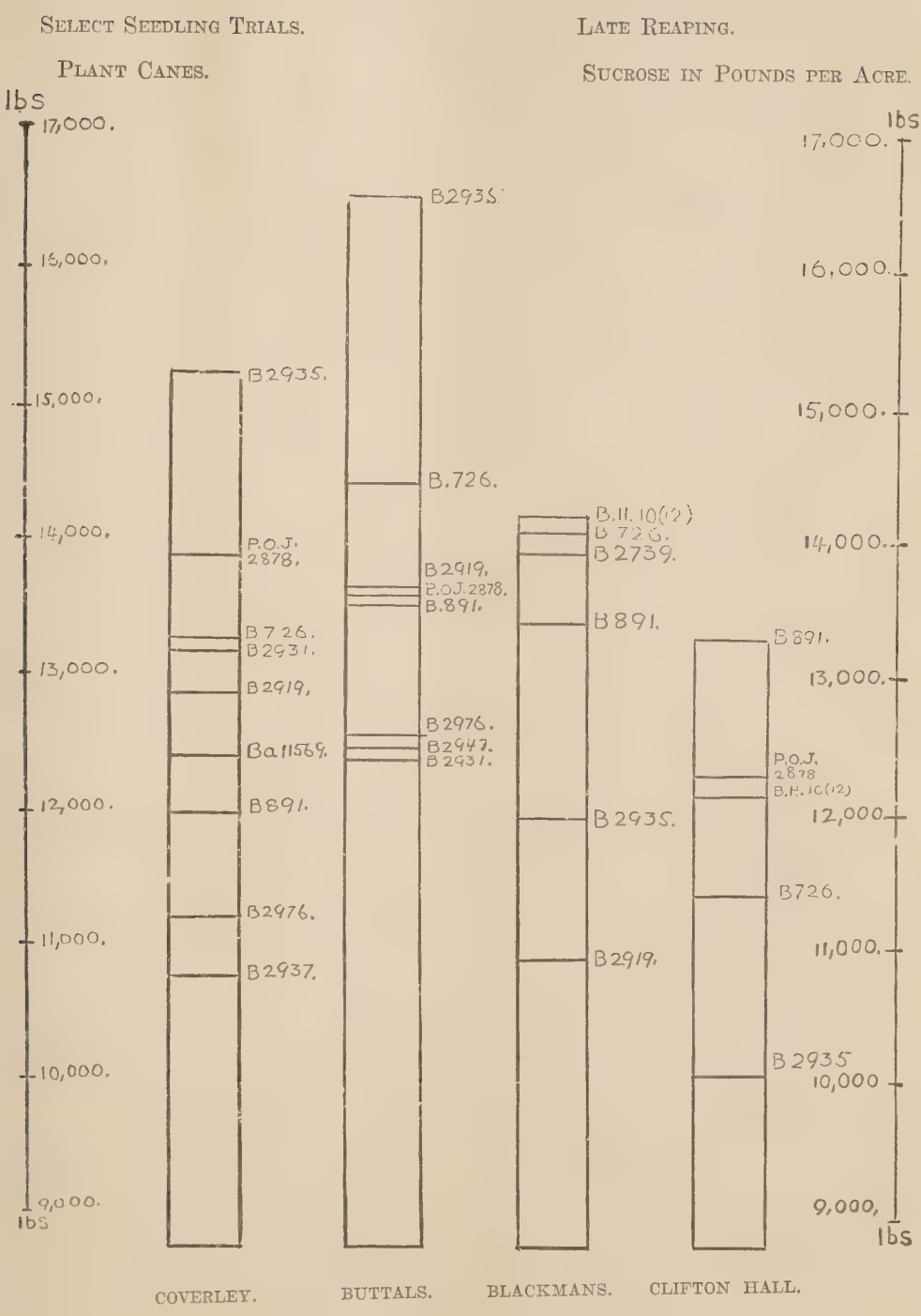
EARLY REAPING.

SUCROSE IN POUNDS PER ACRE.



COVERLEY. BUTTALS. BLACKMANS. CLIFTON HALL.

PLATE II.


SELECT SEEDLING TRIALS.
PLANT CANES.
LATE REAPING.
SUCROSE IN POUNDS PER ACRE.
lbs
17,000.
16,000.
15,000.
14,000.
13,000.
12,000.
11,000.
10,000.
9,000.
lbs
B2935.
P.O.J. 2878.
B726.
B2931.
B2919.
Ba11569.
B891.
B2976.
B2937.
B2935.
B.726.
B2919.
P.O.J.2878.
B.891.
B2976.
B2947.
B2931.
B.H.10(12)
B726.
B2739.
B891.
B2935.
B2919.
B891.
P.O.J. 2878
B.H.10(12)
B726.
B2935
COVERLEY.
BUTTALS.
BLACKMANS.
CLIFTON HALL.

The extent of development of leaf symptoms of gumming disease is much less marked than in Ba.11569, and no deaths of canes from gumming disease were seen.

In general, it is a fast growing variety, which produces very fine tonnages over a comparatively short favourable growing season. Its juice qualities are good under conditions favouring rapid juice improvement.

As a result it is best suited to the lower rainfall districts in the island, but does not appear to be a suitable variety for the longer growing season and slower ripening conditions of the higher rainfall district.

This variety has been planted in variety trials.

B.2931. A seedling of Ba.11569 x B.H.10(12).

This seedling gives promise as an early variety for the lower rainfall district. It will be tried under such conditions in the select seedling trials 1933-35.

B.2977. A seedling of Ba.11569; male parent unknown.

This seedling shows promise for similar conditions as B.2931. It will be tried in the same trials.

P.O.J. 2878.

This Javan variety was tried at all select seedling stations. Two classes of canes are recognised in its stools, i.e., (1) canes formed before September and (2) late canes ("October shoots"). The proportion of these canes varies. It is generally higher for the canes of the first class in the shorter favourable growing season of the lower rainfall districts.

The canes formed before September arrow if the crop is forward; in delayed growth, as experienced at Coverley, they may avoid arrowing. These canes tend to rot or dry out during crop, more particularly if they have arrowed.

The late canes are individually very heavy, and it is suspected they gain weight as crop progresses. Rotting is little in evidence in these canes.

It appears to perform relatively better when cut late in crop. At Coverley and Buttals its weight increased at the late reapings, while at Clifton Hall it lost considerably less in tonnage between early and late reapings than any of the other varieties in the trial.

Its juice quality improves to a relatively greater extent than most other varieties with the progress of the crop, so that at later reapings it is as high as the best Barbados varieties in this respect.

It performed relatively better in the lower than the higher rainfall districts.

Generally, it performed relatively better as a late cut variety in the lower rainfall districts. It is not expected to better B.2935 under these conditions. In the higher rainfall districts it is quite inadequate as an early cut variety

and it is doubtful if it will be equal to Barbados varieties as a late cut variety under these conditions.

At the moment it cannot be said to offer pomise as a commerical variety in Barbados. A further series of trials containing this variety will be reaped in 1934 after which its value in Barbados can be more fully demonstrated.

B. First Ratoons.

Only one of the two first ratoon trials could be reaped as the other was destroyed by fire.

At Blackmans plantation six varieties randomised in approximately 1/36 acre plots in each of seven blocks were reaped on 20th April.

The yields of millable cane were ascertained. The computed tonnages are presented below.

Variety.	Computed yield per acre. tons.	Statistical Note.
B.H.10(12) ..	41.33	A difference of ± 4.77 tons per acre or more between variety means may be regarded as significant.
B.374	39.83	
B.726	37.69	
B.891	35.67	
Ba.11569	34.34	
Co.213	32.65	

There was not a significant difference in yield between B.H.10(12), B.374 and B.726. B.H.10(12) gave a significantly higher tonnage than B.891, Ba.11569 and Co.213; B.374 yielded significantly higher than Ba.11569 and Co.213. There was no significant difference between the yields of B.891, Ba.11569 and Co.213.

These results support the evidence of previous ratoon trials in that they show the strong ratooning power of the standard varieties, B.726 and B.H.10(12) in the higher rainfall ratooning districts.

Co.213 has yielded poorer relative to the other varieties as ratoons than as plant canes. It does not appear to have any direct commercial value in Barbados, but it may prove useful as a parent variety in breeding.

(vii) VARIETY TRIALS.

Variety trials are the final stage in determining whether a sugar cane seedling is fit to be recommended as a commercial variety and for this purpose the data from these trials is combined with the data from second year and select seedling trials, gumming disease and maturity experiments.

The data from the preliminary trials is taken to determine whether any seedling is sufficiently promising for variety trials and where and for what time of reaping in crop it appears to be relatively best suited.

This type of trial is now being carried out to test B.2935 in the lower rainfall districts against the standard commercial varieties, Ba.11569, B.891 and B.726. Twelve estates have been chosen as representative of the sugar cane lands in the lower rainfall districts of Barbados.

An example of these trials is given here:—

Varieties	—	B.2935, Ba.11569, B.891.
Randomised Blocks	—	4.
Size of Plot	—	160 cane holes, i.e. approximately 1/9 acres.

These trials were planted in 1932 and will be reaped by estate labour under the supervision of an officer from the Agricultural Department in the spring of 1934. The plots will be weighed at factory scale beams near the various trial fields.

(B) SUGAR CANE SPECIAL INVESTIGATIONS.

(viii) MATURITY EXPERIMENTS.

The 1931-33 series of maturity experiments was reaped during the 1933 crop season. This represents the fourth season of these experiments.

They have been laid out and reaped so as to test the growth response of (1) commercial Barbados varieties (2) imported varieties and (3) promising Barbados seedlings under two environments and at three reaping times in crop, i.e. early, medium and late.

The growth responses at crop have been measured in terms of (a) number of sound canes (b) their weight (c) their percentage sucrose in the juice and (d) the incidence of rotten or dried out canes. At crop time the number and weight of sound canes and the number of rotten canes have been determined for sets of canes produced early, midway and late in the growing season.

During the growing season periodic growth measurements on the above ground parts of several varieties have also been carried out in these experiments.

During the 1933 crop, data was also obtained for each variety for the length, width and number of internodes of samples of the three types of cane under the two environments for the three reaping times.

The data acquired from all these sources is being worked upon and will be published separately from this report.

The analysis of the results of the investigations in these maturity experiments is revealing the essential differences between varieties in the growth of their above ground parts and of the relative varietal contributions of these parts to the features of commercial value.

More particularly are they proving of value in the recognition of varietal growth types, with suggestions and reasons for their relative suitabilities to different environments.

These experiments are being continued for the 1932-34 crop season.

(ix) SUGAR CANE GROWTH MEASUREMENTS.

Systematic periodic growth measurements on the above ground parts of sugar cane varieties were carried out in maturity experiments during 1932 on the same lines as in previous years.

Varietal growth measurement data have now been obtained for four crop seasons, i.e., from crops 1928-30 to 1931-33 inclusive.

The results of the measurements for the four crop seasons have been analysed and compared and considerations of the findings presented under two main heads, i.e., (1) the effect of environment, more particularly rainfall and temperature, on the growth of sugar cane in Barbados and (2) the growth response of sugar cane varieties to different environments, more especially as concerning their commercial suitabilities to these environments.

For the purposes of this report those features of the findings in Barbados of a practical importance are presented here in a summarised form.

1. Varieties differ chiefly in the time and extent of cane production and the length of time during which such canes may vegetate.

2. In regard to time of cane production a continuous range is met with in varieties but categories may be recognised: thus, (1) varieties which produce canes early and go on producing canes over a long period—e.g., B.891 and B.H.10(12), (2) varieties which produce canes early and go on for an intermediate time, e.g., B.417 and B.2935, (3) varieties which produce canes early and for a short time e.g.—P.O.J. 2878, Co.213, (4) varieties which produce canes slightly later than in the previous category but for a short time, e.g., B.726 and Ba.11569.

3. Arrowing phenomena and measurements of cane length increases give indications of the length of the vegetative period in canes. In this respect varieties with canes of a shorter and of a longer vegetative period are recognised.

   Thus the canes in, e.g., P.O.J.2878, Co.213 have a shorter vegetative period, those of B.417 and B.891 an intermediate one and those of B.726, Ba.11569 and B.H.10(12) a longer period.

4. The production of late canes (''October Shoots'') on the part of some varieties constitute a distinct set of canes in the stool. There is a marked lull in cane production between the canes formed which constitute the original stool and the production of these late canes. The production of the latter is considered a response under good growth conditions to the ageing of the earlier formed canes in the stool as seen by their

arrowing or slowing down of growth. Good examples are seen in P.O.J.2878, Co.213, B.417 and B.2935.

5. The phenomenon of late cane ("October Shoot") production is regarded as an excellent indicator of the variety growth type.

6. The cycle of cane production in time in any variety may be earlier or later according to the length of favourable growing season. The production of late canes may be greater or less according as the favourable growing season is longer or shorter. In a long favourable growing season, the entire cycle of cane production being brought forward, varieties which under average conditions show little or no late cane production, e.g., Ba.11569 and B.726, do produce late canes.

7. The tendency of canes to rot or dry out in crop is, among other things, dependent on the extent of growth made by the cane up to crop and the extent of growth vigour still left in the cane during crop. Canes which have grown over a longer favourable growing season rot or dry out more quickly than those which have grown over a shorter favourable growing season. Thus, following a longer favourable growing season rotting is greater than following a shorter favourable growing season. Varieties which form canes earlier and possess canes of a shorter vegetative period rot or dry out more readily. Finally, within any variety the earlier produced canes rot or dry out more readily than the later produced canes.

8. During crop, within varieties the earlier formed canes reach their juice optima earlier than the later formed canes.

9. The extent of cane formation is a varietal characteristic and is also influenced by the growth conditions. Varieties which tend to tiller freely and produce canes over a long period—e.g., B.H.10(12), require long favourable conditions to do so. Shorter favourable conditions tend to react very unfavourably on such a variety type.

10. These findings explain the distribution of varieties in commercial plantings in the past and will aid in guiding the selection and allocation of seedlings to trials in the future.

11. It is obvious that any selected seedling must attain a minimum general standard in its initial performances before it is selected for further trials.

12. From this general seedling material it is expected that for districts where conditions are such as to give a longer favourable growing season, those types whose canes are produced and vegetate over a longer period are desirable. Other things being equal they will take full advantage of the conditions and they will not rot so readily in crop.

For those districts which have a shorter favourable growing period those types which produce their canes early, and for a short period but vegetate sufficiently and avoid arrowing are desirable. Late cane pro-

duction by these types is not necessarily undesirable since the conditions at crop are such as to force them early to their juice optima.

The disadvantages of transferring the former type to a district with a short favourable growing season lie in the inability of such a type to produce its cane crop in the shorter time, e.g., B.H.10(12).

The early and short duration cane producing type, on being transferred to the districts of longer favourable growing season produces its first canes still earlier and gives a higher number of late canes. At crop time those canes produced early tend to rot readily, those produced late tend to be late in reaching their juice optima. These two features are incompatible as far as the commercial value of the variety is concerned under such conditions, for while waiting for the juice of the late canes to improve the early formed canes are rotting badly. Examples are seen in P.O.J.2878, B.417 and B.2935.

The type which produces canes slightly later than the above, but over a short period, occupies an intermediate position. Good examples are seen in the varieties Ba.11569 and especially B.726. The latter variety is best suited to an intermediate length of favourable growing season, but may perform well in longer or shorter. The limitations of its growth type are seen in that, if kept too long in crop in the longer favourable growing districts it will tend to rot; if grown in a very short favourable growing season it has not sufficient time to form its crop.

Those findings are being used in the sugar cane seedling breeding and selection work.

Sugar cane growth measurements are being carried out this crop season on plant canes and ratoons.

Among the varieties being measured in the plant canes are four seedlings of the B.30' series.

(x) ROOT SYSTEM INVESTIGATIONS.

Experiments to investigate the root systems of sugar cane were started at the beginning of 1933. A detailed report of the findings from these experiments will be published in due course.

The object of this first set of experiments is to determine the growth and development of the root systems of the varieties Ba.11569, B.726, B.H.10(12), P.O.J.2878 and Co.281 under one set of conditions. These varieties were selected to give representatives of three distinct lines of breeding and resulting growth types, i.e., (1) Barbados—Ba.11569, B.726 and B.H.10(12), (2) Javan, nobilised *Saccharum spontaneum*—P.O.J.2878 and (3) an Indian (Coimbatore) type—Co. 281. The three Barbados varieties represent distinct growth types within the Barbados bred varieties.

Growth and development in time is to be noted by making examinations when the stools have grown for four, eight and twelve months.

The examinations at each time consist in determining the spatial distribution of the roots by direct examination of a vertical section made near the base of the stool and by root weight samplings derived from soil horizons of increasing depth.

At each time of examination the characteristics of the roots are ascertained.

From the three time investigations, it is hoped to build up for each variety a qualitative and quantitative history of its root development under the conditions of the experiment.

At the conclusion of each time examination the stools are lifted and studies made on the mode of underground branching, tiller development and the source and nature of the roots at and near their points of origin.

(xi) OBSERVATIONS ON GUMMING DISEASE (*Bacterium vascularum* (COBB) GREIG SMITH).

Leaf symptoms of this disease occur throughout the island but are especially noticeable in fields of the Ba.11569 variety. The disease is also present in St. Kitts and Antigua.

Its commercial significance has been pointed out in Queensland in the death of canes of susceptible varieties. As a result it is necessary to test seedlings and commercial Barbados and imported varieties to note their reactions to this disease.

The relatively high susceptibility of Ba.11569 to infection with the disease and the development of leaf symptoms has not, as far as can be ascertained, been associated with any marked losses in the field or factory, but the very nature of the disease may be such as to effect losses, under certain sets of conditions, in any variety susceptible to such a degree.

An experiment was carried out in 1932. This was essentially similar in lay-out to gumming disease resistance trials carried out in 1930 and 1931. It consisted in replicating three hole plots of each of the varieties to be observed in single row blocks. These blocks alternated with single row blocks planted in Ba.11569. The rows were placed at right angles to the prevailing wind and the Ba.11569 plants acted as sources of infection to the observed varieties. Periodic observations were made during the rainy season and notes were made at each examination to provide information for each variety tested on the time of appearance and extent of development of the gumming disease leaf symptoms. The extent of the symptoms developed was noted by assigning symbols to each variety: thus N = no symptoms seen, T = trace, + = decided appearance of symptoms but in small amount, etc. Ba.11569 which acted as a standard for comparison was allotted the symbol + + + +.

A close watch was kept to note if the cause of the death of any cane could be ascribed to the disease.

The following remarks summarise the results of the observations.

Death of canes in two seedlings was strongly suspected to be caused by gumming disease. These were seedlings derived from Barbados parent varieties. No deaths which could be suspected of being caused by gumming disease were seen in Ba. 11569.

The extent of leaf symptom developments ranged over the varieties from complete absence to the intensity seen in Ba.11569. On the average, susceptibilities to disease, as judged by leaf symptoms, appear to be greater in Barbados commercial varieties and seedlings than in Javan varieties of the P.O.J. series (both nobilisations of *Saccharum spontaneum* and *S. barberi*), than in Indian—Coimbatore—varieties and in crosses between Javan and Barbados varieties. These are generalisations, but even within these groups considerable variations between varieties were noted. It appeared from the limited numbers of each cross tested that Barbados seedlings derived from distinct crosses differ in this respect, e.g., a high percentage of the seedlings from Ba.11569 x B.H.10(12) showed small leaf symptom developments while the reverse was the case among seedlings derived from Ba.11569 x Ba.6032.

The fact that gumming disease in Barbados appears to be capable of destroying canes emphasizes the necessity of testing seedlings by such systematic trials. From the breeding point of view accumulated data from such trials will reveal, as indicated above, hereditary tendencies in the varieties used as parents in regard to reactions of their seedlings to the disease. Other things being equal those parents, the majority of whose seedlings show considerable resistance are to be preferred to those whose seedlings tend to show marked susceptibility.

Further trials have been planted for examination during 1933 on the above lines and to note the correlations existing between extents of leaf symptom development, the death of canes and the extent of systematic infection as judged by the relative amounts of gum exuded by cut canes of varieties.

The second year seedlings now grown in trials at Dodds have been so planted as to expose each seedling to infection. Notes will be made from observations during the year on their reactions to the disease and this will be a further feature for consideration in selecting for further trial.

(xii) EXPERIMENT TO DETERMINE THE CORRELATIONS IN SEEDLINGS IN (1) WEIGHT, (2) PER CENT. SUCROSE IN JUICE AND (3) NUMBER OF CANES BETWEEN THEIR FIRST AND SECOND YEARS' REAPINGS.

This experiment was a repetition of two former ones except that per cent. sucrose in juice and cane number were also correlated. Its object was to find out in how far a selection of seedlings in subsequent trials tend to retain their first year relative placings in the features (1) weight (2) per cent. sucrose in juice and (3) number of canes.

It has always been difficult at the first year seedling reapings to know in how far the figures for these features are reliable guides in estimating the later relative value of each seedling. This is made especially so, as in the first year

each seedling is represented by one stool only. The experimental error involved in single stool determinations of these features in any one variety is high, and there is the possibility of a differential response in these features by the selected seedlings in the different sets of environmental conditions in the different crop seasons in which they are grown.

The experiment consisted in making a selection of forty healthy seedlings within a restricted area in the first year seedling block in 1931. These seedlings were selected to give a range in weights of stools (6 lb.—66 lb.) Their canes were numbered and samples were taken for sucrose in juice determinations.

They were multiplied during 1931, planted in November of that year and reaped in the 1933 crop season. The seedlings were randomised in approximately 1/100 acre plots in each of four blocks. At reaping, precisely similar data as taken in the first year was obtained for each plot.

The following correlations were obtained for each feature in the forty seedlings.

Feature.	Correlation Co-efficient.	Remarks.
(1) Weight.	+ 0.541	All three correla-
(2) Sucrose per cent. in juice ..	+ 0.673	tions are highly sig-
(3) Cane number	+ 0.675	nificant.

These correlation figures indicate a high positive relationship for each feature in their relative developments by the forty seedlings as first and second year plants.

The weight correlation figure confirms the positive trend in this feature as seen in those figures for two previous experiments (q.v. Rept. Dept. Sci. & Agri., Barbados. 1930-31, page 34 Table IX).

It has been found that some seedlings tend to depart considerably in their relative placings between the years but these are the exceptions and provisions cannot be made under the present scheme to enlarge the number of first year selections in the hopes of obtaining the few which may improve disproportionately.

The conclusions from these experiments are, that with suitable precautions exercised at selection in the first year, these features are of value in selection within classes of seedlings (e.g. Barbados crosses).

(xiii) EXPERIMENTS TO DETERMINE THE EFFECT OF VARIOUS TREATMENTS OF SUGAR CANE CUTTINGS ON THE RATE AND EXTENT OF GERMINATION AND THE YIELD OF CANE.

Soaking sugar cane cuttings prior to planting in water or in a solution of some chemical in water has been and is still carried out in many sugar cane growing countries.

Apart from the advantages from this practice in killing parasitic insects and fungi, it has been claimed that the use of chemical solutions increases the rate and the extent of sprouting and the yield of the resulting crop.

A high and speedy germination is always desirable. Considerable difficulty is sometimes experienced in Barbados in this respect more especially in some commercial varieties.

The experiments reported below were carried out to determine if any advantages resulted from the use of three chemical solutions which have recently been used with success in other countries.

In Barbados, cuttings may or may not be soaked in water prior to planting.

Five treatments were therefore tried, i.e.:—

(1) No soaking -- .. .. .. —A.
(2) Water alone .. .. .. —B.
(3) ½% solution of Ferrous Sulphate .. .. —C (1).
(4) Saturated limewater .. .. .. —D (2).
(5) Limewater (as in 4) plus 1 lb. magnesium sulphate to 50 gallons of water .. .. .. —E (2).

Soaking was done in all cases for forty eight hours. Planting material consisted of two eye plants, clean and free from moth borer and these were selected at random from the total number of plants to be planted in any experiment to each of its treatments. The plants for the treatment—no soaking, were cut on the morning of planting.

One experiment was carried out in the planting season of 1930 and two in 1931.

References (1) Rept. Com. in Charge Exp. Sta., Haw. S.P. Ass. 1928.
(2) Louis. Pl. and Sugar Man. May 7th, 1927.

EXPERIMENT I. 1930.

Variety—B.891.
Treatments—5 (A.B.C.D.E. q.v.).
Randomised Blocks—5.
Size of Plot—70 cane holes, i.e. approximately 1/25 acre: two cuttings per hole.
Date of Planting—22nd December, 1930.
Date of Germination Counts—5th, 9th, 15th, 22nd and 30th January, 1931.
Rainfall at Codrington Station—
October, 1930—4.18 inches
November „ —3.33 „
December „ —2.09 „
January, 1931—1.15 „

RESULTS.

A. **Effect of Treatments on Actual Germination as Noted on 30th January, 1931.**

Possible number of Plants per Plot—140.

Treatment.	Actual Germination Mean of five Plots.	Percentage of Possible Germination.
C	58.0	41.2
D	55.0	39.1
E	34.6	24.6
B	27.8	20.7
A	14.2	10.0

Statistical Note:—Any difference between means of ± 11.8 or more may be regarded as statistically significant.

B. **Effects of Treatments on Time of Germination.**

This is presented in the table below.

The germination figures for each treatment at each observation date were calculated as a percentage of its final germination figure, i.e. about 5½ weeks after planting. Each figure is derived from the mean of the five plots.

Date.	Treatment and Percentage Germination.				
	A.	B.	C.	D.	E.
5.1.31 ..	1.52	18.72	12.58	11.88	14.80
9.1.31 ..	16.72	47.52	39.10	36.36	50.40
15.1.31 ..	42.76	69.84	62.56	61.56	61.40
22.1.31 ..	88.16	82.08	85.00	86.04	82.81
30.1.31 ..	100.00	100.00	100.00	100.00	100.00

SUMMARY.

The actual germinations obtained were very low. This is probably on account of the low rainfall around the planting date. The rainfall figures for the two months prior to planting and for the planting month and that following planting are given. The soil appeared to be lacking in moisture.

Under these conditions treating the cuttings with the half per cent. solution of ferrous sulphate and also with saturated limewater gave increased germinations over the other treatments. There was no significant difference between cuttings soaked in water alone and in limewater plus magnesium sulphate, but both gave better germinations than the unsoaked cuttings.

In regard to the effect of treatments on the speed of germination, it is seen that germinations from soaked cuttings were quicker than those from the unsoaked.

Experiment 2, 1931.

This experiment was a repetition of the one just reported, except that the lay-out differed.

Thus—

Variety ..	— B.891	
Treatments ..	— 5	
Replications ..	— 10 (Student's lay-out).	
Size of Plot ..	— 20 holes (single row plots) ; one cutting per hole.	
Date of Planting	— 21st November, 1931.	
Date of Germination Counts ..	— 7th, 10th, 14th, 18th, 24th and 31st December, 1931 and 5th January, 1932.	
Rainfall at Codrington Station ..		Inches.
	— October, 1931 ..	7.44
	November „ ..	10.43
	December „ ..	0.84
	January, 1932 ..	2.68

RESULTS.

A. Effect of Treatments on Actual Germination as Noted on 5th January, 1932.

Possible number of plants per plot—20.

Treatment.	Actual Germination Mean of ten Plots.	Percentage of Possible Germination.
A.	13.8	69.0
D.	13.2	66.0
C.	13.0	65.0
E.	11.5	57.5
B.	10.2	51.0

Statistical note:—A difference between means of + 2.6 or more may be regarded as significant.

B. Effects of Treatment on Time of Germination.

These figures are obtained as in Experiment No. 1.

Each figure is derived from the mean of ten plots.

Date.	Treatments and Percentage Germination.				
	A.	B.	C.	D.	E.
7.12.31 ..	14.6	15.8	12.3	12.2	18.0
10.12.31 ..	44.5	51.3	49.3	51.7	41.4
14.12.31 ..	65.7	73.0	77.0	74.5	57.6
18.12.31 ..	78.1	83.5	88.6	80.6	70.2
24.12.31 ..	100.0	100.0	100.0	98.0	96.2
31.12.31 ..	100.0	100.0	100.0	100.0	99.2
5.1.32 ..	100.0	100.0	100.0	100.0	100.0

SUMMARY.

Heavy rains fell in the months prior to planting, and in the planting month, November. The germination period, December, had a low rainfall, but the soil was throughout this period moist, as a result of the previous heavy rains.

Under these conditions germinations were reasonably good. The cuttings soaked in water alone showed a significantly slightly lower germination than those from the other four treatments. There was no significant difference between the germinations in cuttings from these four treatments.

In regard to speed of germination it is seen that there was little difference between the differently treated cuttings.

A comparison between the results obtained from these two experiments carried out in 1930 and 1931 leads to the following tentative conclusions.

The moisture conditons in the soil during the germinating period exercise a greater effect on germination than the effect of the treatments employed. Where soil moisture occurs in an amount favourable to germination, soaking the cuttings appears to have no advantageous effect. Where soil moisture is low or of itself not present in amount suited to giving good germinations in unsoaked cuttings, soaking the cuttings improves the speed and extent of germination. In these respects it appears that two of the chemical solutions employed are better than water alone.

Further experiments are necessary to test these findings.

Experiment No. 3, 1931-33.

It has been claimed that the vigour of plants grown from cuttings treated with the chemical solutions used in the previous experiments is greater than that of plants from unsoaked and water soaked cuttings. This increased vigour is claimed to result in higher tonnages.

The experiment reported here was carried out to test this.

The variety B.726 was chosen, since it is a good germinator. This was to avoid, as far as possible, differences in ultimate yields from the different treatments of the cuttings as being due to different percentage germinations. In this respect, supplying was done by suitably treated supply cuttings so soon as appeared necessary.

Details of Experiment No. 3.

Variety	.. ..	—B.726.
Treatments	.. ..	—5 (as in Expts. 1 and 2).
Randomised Blocks	..	—6.
Size of Plot	.. ..	—64 cane holes i.e. approximately 1/27 acre; two cuttings per hole.
Date of Planting	..	—14th November, 1931.
Date of Reaping	..	—2nd February, 1933.

Germination counts were made at approximately five day intervals from the 23rd November until the 23rd December.

The percentage germinations obtained from the original plantings of the cuttings from the five treatments are given here.

Treatment.	Percentage Germination.
A.	92.9
B.	89.9
C.	81.3
D.	89.9
E.	90.4

They are seen to be high and very close for all treatments except C.

The holes were singled out and supplying done wherever the two original cuttings had failed to germinate. With the excellent germination obtained and the quick supplying, full stands were obtained early for all treatments.

Throughout the growing period in 1932, no difference in vigour was noticed in the differently treated plots.

At reaping, the plot yields of millable cane were obtained. The results are presented here.

Treatment.	Treatment Symbol	Computed Yield Per Acre—Tons.
(1) ½% solution ferrous sulphate ..	C	43.40
(2) control, no soaking	A	42.84
(3) water alone	B	41.86
(4) saturated limewater plus 1 lb. magnesium sulphate to 50 gallons limewater	E	40.89
(5) saturated limewater	D	39.18

The variances due to differences between treatments are not sufficiently greater than that due to the experimental error, in order that any statistical significance can be attached to the differences in tonnages between the various treatments.

Under the conditions of the experiment it cannot be said that the vigour and tonnages were increased by soaking the cuttings in the solutions of chemicals in water employed.

(xiv) DISEASE OF SUGAR CANE SEEDLINGS IN THE POTTED STAGE AT CODRINGTON EXPERIMENTAL STATION, 1933.

An unhealthy condition of some of the potted seedlings was noticed early in March. Until this time, 7—8 weeks after potting, growth of the plants had been satisfactory. No improvement was noted after the usual application of nitrogenous manure, and an investigation of the trouble was begun.

The affected seedlings, which occurred in groups in each of the four cisterns, appeared stunted and withered, and there was a characteristic shortening of the young inner leaves, indicating a slowing-down in the growth of the plants. As the disease progressed, the leaves became yellowish-brown and withered, and ultimately many of the affected seedlings died.

On examination, diseased seedlings were found to have a very much reduced root system, with many roots discoloured and rotten. Such seedlings were easily pulled up from the pots on account of the ease with which the rotten roots were broken. Nothing in the above-ground tissues could be found to account for the diseased condition. Microscopic examination of the roots, however, showed the presence of one or more fungi, whose suspected parasitic nature suggest that they may be the cause of the disease.

A full account of the symptoms of the disease, together with sketches and preparations necessary for its identification, was sent to the Imperial Mycological Institute at Kew. The authorities were of the opinion that the diseased condition was the result of infestation of the root systems of the seedlings by one or more soil-inhabiting fungi, which had probably been introduced into the cisterns with the potting soil. They also sent recommendations for the control of the disease in future years.

In the meantime, periodic examinations of the cisterns had been made and the dead and dying seedlings removed in order to minimise the risk of infection of healthy plants.

By April 5th, approximately two thousand two hundred seedlings had died as a result of the disease. This represents a loss of 12.2% in the potted seedlings.

Two hundred seedlings in early stages of the disease were marked, and several cases of recovery were noted among them at later dates.

As the seedlings grew larger, the disease decreased in severity, which suggests that young seedlings only are subject to infection. Subsequent to the planting of the seedlings from the pots into the field, the disease has not been seen, and no losses of seedlings in the field can be traced to this cause.

Precautionary measures against the recurrence of this disease in the future are being considered.

SECTION II.

SWEET POTATOES.

(i) VARIETY TRIALS.

(a) Sweet Potato Catch Crop Trial 1932.

The object of this trial is to test and select varieties which promise to better the existing commercial varieties in one or more features in a short growing period of approximately sixteen weeks.

The trial was planted at Codrington Experiment Station in July 1932 and dug after a growing period of about seventeen weeks.

The varieties tested contained (1) local varieties (2) introduced varieties and (3) selections from Barbados seedlings raised in 1928. The latter comprised those eleven seedlings tested for the first time in the 1931 catch crop trial. The local varieties consisted of two commercial standards, Six Weeks and Red Nut and three varieties grown on a very small scale in the island. The imported varieties were from Mauritius, Queensland and St. Vincent.

The usual field data was taken at digging and for each variety five independent judgments were given on its cooking qualities. As a result of the trial two of the Barbados seedlings—B.8 and B.10—,two of the Barbados varieties grown on a small scale and one of the Queensland varieties were eliminated.

(b) Sweet Potato Long Crop Trial.

The object of this trial is to obtain varieties which are better than the standard—Trinidadian (synonym Black Rock)—more particularly in yielding capacity, over an approximately twenty-four weeks growing season.

The long crop trial was carried out at Malvern plantation.

The trial contained two Barbados standard varieties, Red Nut and Trinidadian, two Barbados varieties little grown in the island, six Barbados seedlings and four imported varieties. The trial was planted in November 1932 and dug in May 1933. The usual field data was taken at digging.

(c) General Observations on Variety Trials Carried out from 1929-1933 Inclusive.

The Barbados seedlings included recently in variety trials have not yet been sufficiently tested and will not be considered here.

The observations here reported concern the performances of Barbados varieties and imported varieties.

Of the Barbados varieties, the quick cropping varieties Six Weeks and Red Nut have performed consistently well. Both yield a comparatively heavy crop of potatoes over a short growing period. The potatoes are generally acceptable from the cooking point of view. Both, however, fail to keep sound for any length of time after digging.

The variety Trinidadian (synonym Black Rock), which is generally grown under long crop conditions is well known locally for producing good quality potatoes which do not bruise readily and may be stored for a considerable time after lifting. By virtue of the latter feature it is well suited for export to other islands. As far as its yield is concerned, however, in the series of trials it has performed poorly, being as a rule among the lowest yielders in all the trials.

No other Barbados variety included in these trials has shown any signs of promise.

Of all the imported varieties tested, the St. Vincent variety, V.52 has done best and is certainly worth small scale estate plantings. Throughout the trials it has yielded at least as well as Six Weeks and Red Nut. Moreover, from observations made in crate storage in 1930, its potatoes appeared to remain sound throughout a three month storage period, whereas both Six Weeks and Red Nut showed considerable rotting, and were very readily eaten by mice and birds. It yields a good crop of potatoes in a short time. The potatoes are above average in size, possess a white skin and white flesh and are easily dug.

On cooking the flesh is white tinged with green, moist and sweet. Reports on its cooking qualities are variable, but on the average favourable.

It appears worthy of a preliminary small scale planting both for catch and long cropping purposes and for trial shipments to other islands.

Four American varieties were tried, but these all gave poor yields and were discarded.

Three seedlings from the Philippines were tested. All bore their potatoes very deeply and in a scattered fashion. As a result they were difficult to dig. Moreover, they gave mediocre yields and did not appear to remain sound for any length of time after digging. These have been eliminated from further trial.

Two Mauritius varieties have been tried but neither so far shows promise for commercial planting. They will be given another trial.

Five varieties were imported from Queensland. Three were soon eliminated on account of poor appearance and/or poor yielding ability. Two were given further trials. One of these, Brook's Gem, bears bunched, evenly spindle shaped white potatoes. They are easily dug, but their yield is only average. As a variety, it does not seem to offer any advantages over Red Nut and Six Weeks.

The other is Brook's Seedling No. 3. It has yielded consistently well, but cooking reports are not favourable, and as a result, may not be acceptable as a general purpose variety.

Two varieties were imported from St. Kitts, but were eliminated on account of their very low yielding ability.

(ii) SEEDLING RAISING AND SELECTION.

The object here is to improve on the standard of the sweet potato commercial varieties at present grown by the raising and selection of seedlings.

A first series of seedlings was raised from seed collected and germinated in 1928. The various trials and selections made on these seedlings have been reported on from time to time. Selections from these have now reached variety trial stage and are reported on in these trials as numbered B.—Barbados—varieties.

This section reports progress on a second series of seedlings.

The seeds were collected from varieties in the "long-crop" trial at Ashbury plantation in 1932. The varieties in the trial were randomised in small plots and it was hoped that many of the seeds collected would be the resultant of natural cross fertilisation.

The seeds were germinated in April 1932. To aid germination the seed coats were shaved to the underlying cotyledons at a point away from the embryo. They were then placed in dishes on moistened filter paper, and on the emergence of the radicles, carefully placed in little holes made in the soil in 6" pots. By this method a germination and establishment of close on 90% was obtained.

In June 1932 the potted seedlings were planted out. The numbers planted and their sources are presented below.

Parent Variety	Source	Number of Seedlings Planted in Field.
Red Nut	Barbados	758
Egyptian	Mauritius	300
B.6	Barbados	240
B.7	Barbados	200
Philippine Seedling	Philippines	191
Brook's Seedling No. 3.	Queensland	120
Trinidadian	Barbados	128
V.52	St. Vincent	116
Six Weeks	Barbados	57
	Total	2,110

The populations from each parent were planted out in strip plots of equal length but varying width. Every alternate plot was planted in seedlings of Red Nut.

The seedling block was divided approximately into half, the division being made at right angles to the length of the plots.

Seedlings in one half were dug after 15½ weeks growth and were used as a medium for selecting early cropping types. The seedlings in the other half were dug after approximately 23 weeks to give long cropping types.

At digging the potatoes of seedlings giving potatoes weighing above a certain fixed weight were set aside and labelled. Observations were then made on these potatoes to note their size and shape uniformity, smoothness of skin and colour of flesh. The most desirable ones were then selected and the potatoes used for multiplication purposes.

For further trials in 1933, 106 were selected for short cropping and 100 for long cropping; representing approximately 10% and 9.4% respectively of the total number of seedlings dug at each time of digging.

SECTION III.

YIELDS OF SUGAR CANE PER ACRE.

Ninety-one plantations submitted returns of yield of sugar cane per acre harvested during the crop season of 1933 and the area involved was 9733 acres. Considering the fact that few of the plantations which grind with windmills or small steam plants are able to weigh their canes the acreage returned is satisfactory. It is hoped, however, that planters in future years will make every endeavour to make these records more complete, for it is only by such comprehensive returns that planters can determine which are the most suitable sugar cane varieties for their respective areas.

A study of the three tables below will show that the B.891 variety was not a failure. It will be remembered that in November 1931 at the time of planting, there were grave doubts as to whether the Ba.11569 variety might break down on account of the gumming disease. As a matter of fact no trouble was experienced in the factories and no deaths of cane, due to gumming, were reported from the field.

On the other hand, the B.891 variety gave as good a yield as the Ba.11569 and had a much better juice, so that it is safe to say that the B.891 increased the yield of sugar per acre where it was planted instead of Ba.11569.

The great superiority of the B.726 and B.H.10(12) varieties in the wetter areas is clearly demonstrated from the tables and it will be extremely difficult to produce another seedling to surpass either of these two varieties.

LOW RAINFALL AREAS (UNDER 46").

Variety.	Whether Plant Canes or Ratoons.	No. of Acres on which figures have been calculated.	Tonnage per acre.
Ba. 11569 ..	Plant Canes ..	120	22.57
„ ..	1st Ratoons ..	58	21.84
„ ..	2nd „ ..	5	26.40
„ ..	3rd „ ..	..	..
B. 891 ..	Plant Canes ..	162	21.71
„ ..	1st Ratoons ..	..	..
B. 726 ..	Plant Canes ..	143	22.23
„ ..	1st Ratoons ..	11	13.64
„ ..	2nd „ ..	..	..
B.H. 10(12) ..	Plant Canes ..	..	..
„ ..	1st Ratoons ..	..	..
„ ..	2nd „ ..	..	..
„ ..	3rd „ ..	..	..
B. 417 ..	Plant Canes ..	168	18.48
„ ..	1st Ratoons ..	3	13.00
B. 374 ..	Plant Canes ..	28	20.57
„ ..	1st Ratoons ..	..	..
„ ..	2nd „ ..	..	..
B. 755 ..	Plant Canes ..	21	12.09

INTERMEDIATE RAINFALL AREAS (46″—60″).

Variety.	Whether Plant Canes or Ratoons.	No. of Acres on which figures have been calculated.	Tonnage per acre.
Ba. 11569 ..	Plant Canes ..	218	29.66
„ ..	1st Ratoons ..	376	29.66
„ ..	2nd „ ..	6	26.40
„ ..	3rd „ ..	..	..
B. 891 ..	Plant Canes ..	1,813	28.23
„ ..	1st Ratoons ..	162	25.92
B. 726 ..	Plant Canes ..	904	30.70
„ ..	1st Ratoons ..	243	26.31
„ ..	2nd „ ..	5	24.42
B.H. 10(12) ..	Plant Canes ..	130	34.47
„ ..	1st Ratoons ..	35	33.58
„ ..	2nd „ ..	..	..
„ ..	3rd „ ..	..	..
B. 417 ..	Plant Canes ..	190	24.13
„ ..	1st Ratoons ..	20	22.20
B. 374 ..	Plant Canes ..	121	28.74
„ ..	1st Ratoons ..	106	23.46
„ ..	2nd „ ..	..	..
B. 755 ..	Plant Canes ..	46	25.29

HIGH RAINFALL AREAS (OVER 60″).

Variety.	Whether Plant Canes or Ratoons.	No. of Acres on which figures have been calculated.	Tonnage per acre.
Ba. 11569 ..	Plant Canes ..	66	33.77
„ ..	1st Ratoons ..	252	35.42
„ ..	2nd „ ..	45	29.66
„ ..	3rd „ ..	27	33.54
B. 891 ..	Plant Canes ..	498	34.77
„ ..	1st Ratoons ..	203	31.36
B. 726 ..	Plant Canes ..	577	39.48
„ ..	1st Ratoons ..	417	36.45
„ ..	2nd „ ..	113	31.72
B.H. 10(12) ..	Plant Canes ..	932	40.70
„ ..	1st Ratoons ..	623	34.32
„ ..	2nd „ ..	370	31.05
„ ..	3rd „ ..	70	29.24
B. 417 ..	Plant Canes ..	..	..
„ ..	1st Ratoons ..	..	..
B. 374 ..	Plant Canes ..	..	..
„ ..	1st Ratoons ..	38	31.10
„ ..	2nd „ ..	70	29.50
B. 755 ..	Plant Canes ..	8	33.06